



NUCLEONICA Progress Meeting  
Dialogika/ITU  
Karlsruhe, 22 March 2006

# Nuclide Explorer: First observations

## J. Magill

- n (neutron emission) should be added as a decay mode
- show all nuclides with decay mode... when I select “none” all the check boxes should be unchecked. When I select all, they should all be checked
- When I click on a nuclide, a blank page appears
- Element select box is NOT working: try Au191.

(note that when we select an element e.g. Au, there should be NO screen refresh. Screen refresh only when the isotope has been selected e.g. Au191)

- When I click on Au191 in main window, the screen should reload with this nuclide at the centre.
- See printout of Au 191: we need to get Nucleonica and the K'he chart as similar as possible - is there a simple way of doing this?
- draw the magic lines in the same way as NuDat2,

# Nuclide box sub-structure...

## 3 steps:

- Step 1:

At present, the only sub-structure we have is to show metastable states. In some cases there are two metastable states (m and n states). Nucleonica shows this differently to the K'he chart. Is it possible to make it more like the K'he chart?

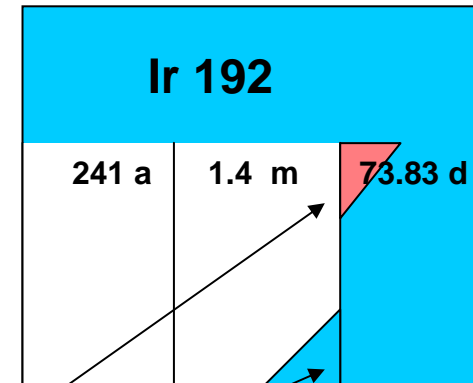
Ir 192		
241 a	1.4 m	73.83 d

In a later step, we will add small coloured triangles to indicate multiple modes of decay.....

# Nuclide box sub-structure...

- Step 1 (cont'd):

At present, the only sub-structure we have is to show metastable states. In some cases there are two metastable states (m and n states). Nucleonica shows this differently to the K'he chart. Is it possible to make it more like the K'he chart?



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# Nuclide box sub-structure...

- Step 2:

Show primordial nuclides (25 in total).  
An example of such a primordial nuclide is shown for Pt 190...

In the top black section, the 0.01 refers to the abundance (the the DB)

Pt 190	
0.01	
6.5 · 10 <sup>11</sup> a	

A more complicated example is U 235....

U 235	
0.7200	
26 m	7.038 · 10 <sup>8</sup> a

# Nuclide box sub-structure...

- Step 3:

Introduce large coloured triangles to indicate multiple decay modes. Consider the nuclide Pa 226. If you look up Nuclides.net you see that the modes of decay are:

Mode	Branching Ratio
$\alpha$	0.74
$\beta^+$	0.26

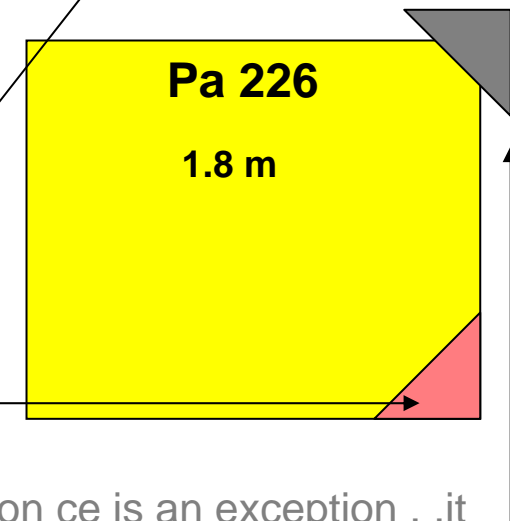
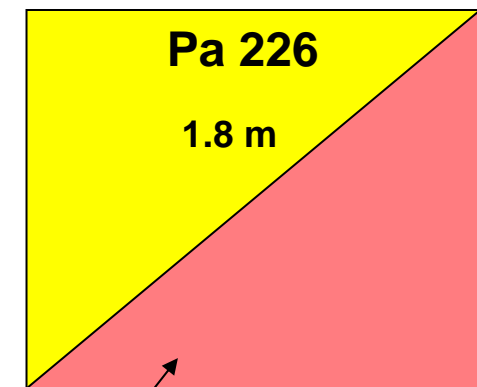
i.e. the main mode is alpha emission with a 74% probability. The subsidiary mode is  $\beta^+$  with 26% probability. The subsidiary mode must always have a branching ratio in the range  $0 < BR < 50\%$ . We now use the following convention:

if  $5\% < BR < 50\%$  then include a large triangle (red triangle shown here).

If the BR of the subsidiary mode is less than 5% (i.e.  $0 < BR < 5\%$ ) then use a small triangle.....

Why is the small red triangle at the bottom right?  
The "order" is given by....p,  $\alpha$ ,  $\epsilon/\beta^+$ , IT,  $\beta^-$ , sf, n.

Cluster emission ce is an exception . .it is a small grey triangle at the top right corner.



# Nuclide box sub-structure...

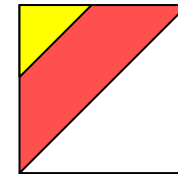
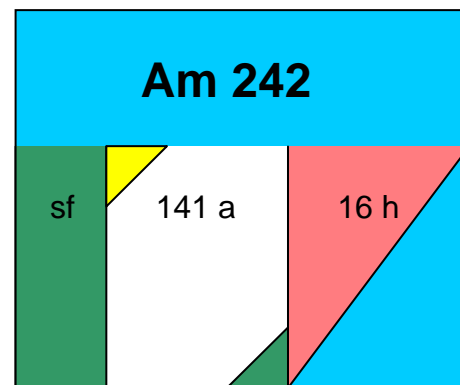
- Step 3 (cont'd):

What happens if there are more than 2 modes of decay??

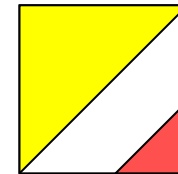
Here are some examples...

Note that these are very special cases.. only a few nuclides are involved.

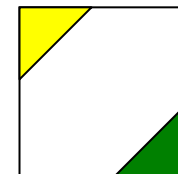
The same can arise with metastable states..



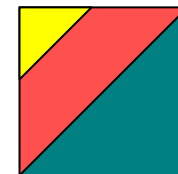
Au184m



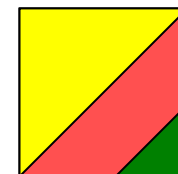
Ac222m



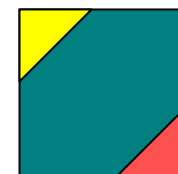
Am242m



Ac226



No254



Es254

The competition solves this problem with *tooltips* – not very satisfactory - we can do it better (although using *tooltips* is a good idea)

**NuDat 2.2**  
New Glossary 3-gamma search

NuDat allows to search and plot nuclear structure and nuclear decay data interactively. [More...](#)

Search Options:  
[Levels and Gammas](#)  
Search on ground and excited states level properties (energy, half-life, spin and parity, decay modes) and gamma-ray information (energy, branching ratio, multipolarity )  
[Nuclear Wallet Cards](#)  
Search on ground and isomeric states level properties, neutron resonance parameters and thermal cross sections  
[Decay Radiation](#)  
Search on radiation type, energy, intensity and dose following nuclear decay

Address: <http://www.nndc.bnl.gov/nudat2/reCenter.jsp?z=77&n=116>

79	191Au 3.18 H €	192Au 4.94 H €	193Au 17.65 H €	194Au 38.02 H €	195Au 186.098 D €	196Au 6.1669 D €	197Au STABLE 100%	198Au 2.6956 D β-	199Au 3.139 D β-																
	190Pt 6.5E+11 Y 0.014% α	191Pt 2.862 D €	192Pt STABLE 0.782%	193Pt 50 Y €	194Pt STABLE 32.967%	195Pt STABLE 33.832%	196Pt STABLE 25.242%	197Pt 19.8915 H β-	198Pt STABLE 7.163%																
77	189Ir 13.2 D €	190Ir 11.78 D €	191Ir STABLE 37.3%	192Ir 73.827 D β-	193Ir STABLE 62.7%	194Ir 19.28 H β-	195Ir 2.5 H β-	196Ir 52 S β-	197Ir 5.8 M β-																
	188Os STABLE 13.29%	189Os STABLE 16.21%	190Os STABLE 26.36%	191Os 15.4 D β-	192Ir				196Os 34.9 M β-																
75	187Re 4.12E+10 Y 62.60% β-	188Re 17.003 H β-	189Re 24.3 H β-	190Re 3.1 M β-	<table border="1"> <thead> <tr> <th>E(level)</th> <th>J<sub>π</sub></th> <th>T<sub>1/2</sub></th> <th>Decay Modes</th> </tr> </thead> <tbody> <tr> <td>0.0</td> <td>4+</td> <td>73.827 d 13</td> <td>β<sup>-</sup> : 95.13 % ε : 4.87 %</td> </tr> <tr> <td>0.0567</td> <td>1-</td> <td>1.45 m 5</td> <td>IT : 99.98 % β<sup>-</sup> : 0.02 %</td> </tr> <tr> <td>0.1681</td> <td>(11-)</td> <td>241 y 9</td> <td>IT : 100.00 %</td> </tr> </tbody> </table>				E(level)	J <sub>π</sub>	T <sub>1/2</sub>	Decay Modes	0.0	4+	73.827 d 13	β <sup>-</sup> : 95.13 % ε : 4.87 %	0.0567	1-	1.45 m 5	IT : 99.98 % β <sup>-</sup> : 0.02 %	0.1681	(11-)	241 y 9	IT : 100.00 %	
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	112	114	116	118	120																				

Ground and isomeric state information for <sup>193</sup><sub>77</sub>Ir

E(level) (MeV)	J <sub>π</sub>	Δ(MeV)	T <sub>1/2</sub>	Abundance	Decay Modes
0.0	3/2+	-34.5338	STABLE	62.7% 2	
0.0802	11/2-	-34.4536	10.53 d 4		IT : 100.00 %

A [list of levels](#), a [level scheme](#) and [decay radiation](#) information are available

This site is better seen using a monitor with a screen resolution larger than 1100 by 800 pixels and with the latest version of internet browsers  
Database Manager and Web Programming: Alejandro Sonzogni, NNDC, Brookhaven National Laboratory, [sonzogni@bnl.gov](mailto:sonzogni@bnl.gov)  
Data Source: National Nuclear Data Center, Brookhaven National Laboratory

<http://www.nndc.bnl.gov/nudat2/reCenter.jsp?z=77&n=115>



Is there a simple way of doing this?

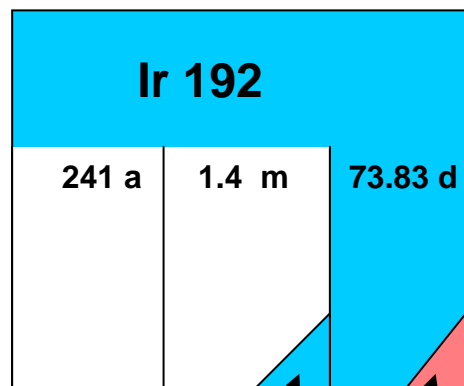
Some observations:

- It is not necessary to have the particles and energies.  
In the paper chart this is forced into a small box. In an electronic product, we have all info in the Datasheets.
- It is not necessary to have various sized triangles corresponding to the magnitude of the branching ratios. Again all this data/information is in the Datasheets
- It is not necessary to adhere to the ordering process in the K<sup>+</sup>he chart
- It is necessary to indicate multiple modes of decay  
This is in order to enable the user to quickly see which daughters or decay products can arise

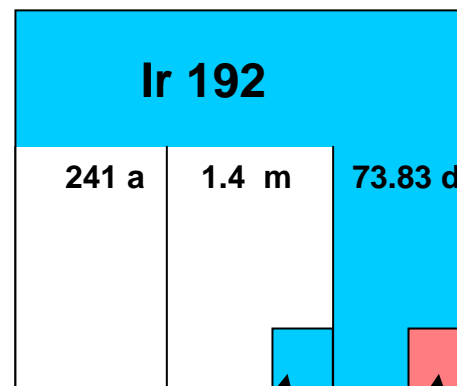
## How to indicate multiple decay modes.....

Basic modes ( $p$ ,  $\alpha$ ,  $\varepsilon/\beta^+$ , IT,  $\beta^-$ , sf, n)\* ....these determine the main colour of the box or box section (for metastable states)

One additional mode of decay....



Additional modes info is located at the bottom right

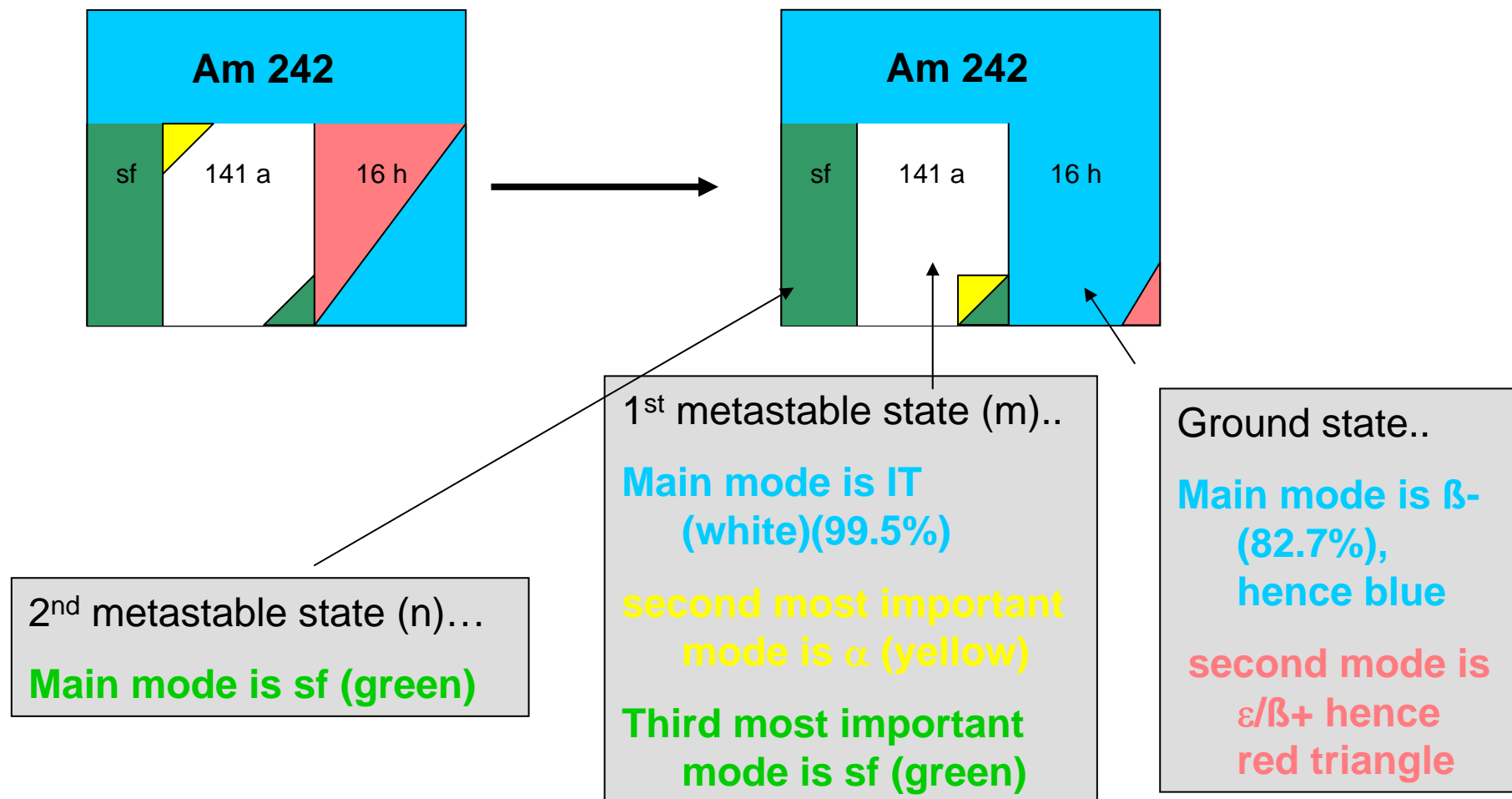


Square boxes can be used if triangles are a problem

\*ce (cluster emission) is not included – this is treated separately

## How to indicate multiple decay modes (cont'd).....

two additional mode of decay....



I think this latter approach is much easier to program. One could imagine an invisible square for every nuclide or metastable state. Then only if there are additional modes of decay do the square become active.

that's it!!